ENERGY AND MACRONUTRIENT INTAKES IN OLDER URBAN AND RURAL IRANIAN ADULTS

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Abstract. Adequacy of energy and macronutrient intakes is important for disease prevention, health maintenance and nutrition program development in older adults. The present study was designed to evaluate and compare the adequacy of energy and macronutrient intakes of elderly living in rural and urban areas in the north-west of Iran. A total of 432 older adults (332 urban and 100 rural) were selected through stratified, multistage probability cluster sampling. Dietetic information was obtained through three-day 24-hour dietary recall interviews. A small proportion of the subjects (4% rural and 0.6% urban) were underweight while approximately half was either overweight or obese. Aged subjects from the urban had a significantly higher mean body mass index (BMI) (t=3.46, p<0.05) than their rural counterparts. There was also significant greater proportion of elderly subjects who were overweight or obese (χ^2=14.42, p<0.05). Older adults from the rural had significant more daily energy (t=3.49, p<0.05), carbohydrates (t=2.96, p<0.05) and fat intakes (t=3.15, p<0.05) than their urban counterparts. Generally, average daily intake of energy was lower than the Recommended Dietary Allowance (RDA) in developing countries. High contribution of carbohydrates and low contribution of proteins to total calory intake were observed in the daily diet of the elderly. There is a need to offer health and nutrition awareness programs for the elderly and their families by health care providers.

Keywords: aged, nutrition, macronutrient intake and energy intake, Iran

INTRODUCTION

The world's population is growing fast towards aging (Hairi *et al*, 2010). It is expected that by the middle of this century one in every five persons will be old (Mujahid, 2006). The rapid changes in the number of aged population caused an increased prevalence of chronic diseases and growth of functional limitations (Nakasato and Carnes, 2006; Singh and Hiatt, 2006). Age-related diseases and its expenditure are increasing and new health programs for the elderly need to be developed (Akbulut and Ersoy, 2008). Diet-related health continues to be a problem for the elderly and for those at risk for malnutrition (Ralston *et al*, 2011). Having a proper diet and regular physical exercise can help to prevent cardiovascular diseases, stroke, hypertension, type two

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diabetes mellitus, osteoporosis, obesity, certain cancers, and dental problems (Salonen *et al*, 2002).

Nutrition for older adults includes a wide range of subjects and issues (Chernoff, 2009). Macronutrient deficiencies and an increased risk of protein and energy insufficiency in the elderly were apparent (Hegeney, 1997; Blumberg, 2007). Adequate nutrition is one of the most essential aspects of health maintenance in the elderly (Ralston *et al*, 2011). Nutritional status is a valuable determinant of quality of life as well as morbidity and mortality. Adequate nutrition, including balanced diet and healthy lifestyle is associated with better quality of life among the elderly (Akbulut and Ersoy, 2008).

In many developing countries, information on the nutritional status and dietary intakes for older adults is scarce. These countries mostly focus on health and nutritional programs for pregnant women and children and only a few programs, if any, are targeted for the aged (Maruapula and Novakofski, 2010). Further, a good knowledge of dietary intake is necessary to improve dietetic counseling provided to both healthy and high-risk aged adults (Féart *et al*, 2007). Hence, this study was designed to investigate the nutritional status and its anthropometric indices among urban and rural older adults.

MATERIALS AND METHODS

The present study was a cross sectional descriptive study approved by the ethics committee of the University of Urmia Medical Sciences, Iran. All the subjects signed the consent forms after being notified of the study procedure. The older adults under special diet and those who were not able to respond or unwilling to cooperate were excluded from the study.

The data were collected through home-visits and face to face interviews using structured questionnaires. The population was sampled using a stratified, multistage probability cluster sampling design. Participants completed a household interview in which information was obtained on demographic characteristics, medical history and dietary intakes. Anthropometric characteristics such as weight and height were also measured in order to determine the body mass index (BMI). BMI was calculated by dividing weight (kg) to the square of height (m^2) and categorized according to World Health Organization (WHO) guidelines that BMI <18.5 as underweight, BMI (18.5-24.9) as normal, BMI (25-29.9) as overweight and a BMI greater than 30 as obese (WHO, 1995).

The 24-hour recall for three consecutive days (non-holidays and non-festival days) was used to determine the food intake of the subjects. Data were collected by four trained dietitians in 40 to 50 minutes. Subjects quantified portion sizes of foods displayed as breakfast, lunch, dinner, and snack by using a photographed booklet according to usual portion size as a small, medium, or large.

Nutrient intake was computed through the Nutritionist software version IV. The average three-daily energy intake and macronutrient values were used for statistical analyses. The nutritional information was compared with the values of the Recommended Dietary Allowance (RDA) for older adults in developing countries (Solomons and Bermudez, 2008).

Data analysis

The statistical analysis was carried out using SPSS® 19 (IBM, Armonk, NY) for Windows at 95% power analysis. Descriptive statistics were performed on demographic characteristics, BMI, energy and

Table 1
Demographic characteristics of the subjects in the urban and rural areas.

Demographic characteristics	All subjects (N = 432)		Rural (N = 100)		Urban (N = 332)		
	n (%)	m (SD)	n (%)	m (SD)	n (%)	m (SD)	p-value
Age (years)		71.5 (6.6)		73.6 (8.1)		70.8 (5.9)	t=0.81, NS
Gender							
Male	168 (38.9)		118 (35.5)		50 (50.0)		χ^2=6.76
Female	264 (61.1)		214 (64.5)		50 (50.0)		$p < 0.05$
Marital status							
Married	242 (56.0)		188 (56.6)		54 (54.0)		
Widowed	181 (41.9)		139 (41.9)		42 (42.0)		χ^2=2.51, NS
Unmarried	5 (1.2)		3 (0.9)		2 (2.0)		
Divorced	4 (0.9)		2 (0.6)		2 (2.0)		
Education level							
No schooling	330 (76.4)		236 (71.0)		94 (94.0)		χ^2=25.25
Schooling	102 (23.6)		96 (29.0)		6 (6.0)		$p < 0.05$

n, number; m, median; SD, standard deviation; NS, not significant.

macronutrients intakes that were reported as means (M) ± standard deviations (SD). Mean nutrient intakes were assessed for normality (Kolmogorov-Sminov, Shapiro-Wilk test, and Skewness) and equality of variance (Levene's test). Independent t-test and chi-square test were used to find out the differences of demographic characteristics, BMI, energy and macronutrient intakes between older adults in the urban and rural area. Significance was set at $p < 0.05$.

RESULTS

Of the 432 study subjects, 23% (100 subjects) with an average age of 73.6 ± 8.1 were from the rural areas and the rest (77% ; 332 subjects) with an average age of 70.8 ± 5.9 were from urban areas. There were significant differences between older urban and rural adults in the distribution of gender and education level (Table 1).

Based on Table 2, urban older adults had significantly higher mean BMI (t= 3.46, p<0.05) and were significantly more overweight and obese (BMI ≥25) than rural older adults (p<0.05).

As depicted in Table 3, the mean daily intake of energy, carbohydrates, and fat was considerably higher in rural elderly compared to urban elderly (p<0.05). However, the mean daily intake of protein in rural and urban elderly was not significantly different.

The percentage of energy derived from proteins was 13% in rural elderly and 14% in urban elderly, which was lower than the recommended value of 1.5 g protein/kg/day or about 15%-20% of total caloric intake (Wolfe *et al*, 2008). The carbohydrate intake contributed to 62% (rural subjects), 63% (urban subjects) in terms of whole energy intake in the diet, which is meeting the recommended

Table 2
Classification of the body mass index of the subjects based on WHO (1995) classification.

	All subjects m (SD)	Urban m (SD)	Rural m (SD)		*p*-value
BMI (kg/m^2)	26.3 (4.6)	26.7 (4.7)	24.9 (3.9)	t=3.46	$p < 0.05$
BMI classification	*n* (%)	*n* (%)	*n* (%)		
< 18.5	6 (1.4)	2 (0.6)	4 (4.0)		NS
18.5-24.9	165 (38.2)	116 (34.9)	49 (49.0)	χ^2=14.42	$p < 0.05$
≥ 25	261 (60.4)	214 (64.5)	47 (47.0)		$p < 0.05$

n, number of subjects; m, mean; SD, standard deviation; NS, not significant.

Table 3
Mean macronutrient intake as assessed with the 24-hour recalls among older adults in the urban and rural area.

Nutrients	All subjects m (SD)	Urban m (SD)	Rural m (SD)	*t*	*p*-value
Energy (Kcal)	1,495 (477)	1,425 (460)	1,638 (505)	3.49	$p < 0.05$
Carbohydrates (g)	236.7 (89.1)	230.0 (85.7)	260.0 (96.7)	2.96	$p < 0.05$
Protein (g)	51.7 (18.2)	51.0 (17.8)	54.1 (19.4)	1.52	NS
Fat (g)	40.0 (17.2)	38.6 (17.2)	44.7 (16.4)	3.15	$p < 0.05$

m, mean; SD, standard deviation; NS, not significant.

RDA for carbohydrate (45%-65%) for older adults in developing countries. The percentage contribution of fats to energy was around 25% in the rural and 23% in the urban elderly, which was within the RDA recommendation of 20%-35% of total energy intake (Solomons and Bermúdez, 2008) (Fig 1).

DISCUSSION

The most important concern of geriatric nutrition is the preservation of good health and prevention of age-related diseases. Generally, people should achieve old age with sound nutrition patterns (Risonar *et al*, 2009). Maintaining a healthy diet is the best way for health promotion, disease prevention, and maintenance of quality of life in the elderly (Marian and Sacks, 2009).

Body mass index is the most frequently used indicator of nutritional status (Barbosa *et al*, 2005). The results of this study were in agreement with Eshaghi (2007) and Dorosty and Alavi Naeini (2007) who reported that more than 60% of older adults were overweight or obese (BMI ≥25). Further, the results were supported by Aliabadi (2007) who showed that obesity in the city was significantly greater than in the rural areas. However, our study was not in good concordance with Ipchi Sheshgelani *et al* (2001) which showed that only 22.2% of the older adults were overweight or obese and 43.8% were underweight. Such discrepancy may be related to the difference in sample sourcing.

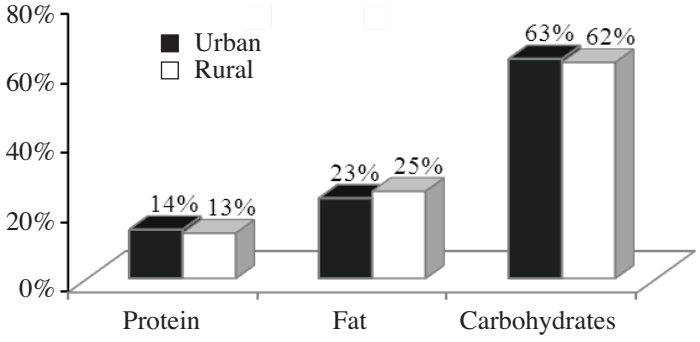

Fig 1–Percentage of energy derived from carbohydrates, protein and fat in the diets of 432 Iranian elderly (332 urban and 100 rural elderly).

Despite there was significantly more overweight and obese among the urban elderly than the rural elderly, energy intake among the rural elderly was considerably higher than their urban counterparts. This may be attributed by the fact that older adults residing in the rural area are physically more active. Overweight and obesities are associated with increased mortality and a number of metabolic and cardiac disorders. It also contributes to functional decline and disability in the elderly (Alam *et al*, 2011). The specific underlying causes of adult weight gain are poorly understood, but can be attributed to the imbalance between energy intake and expenditure (McCrory *et al*, 2000). Further, it seems that the nutrition and cultural patterns of old people under study are an important factor for obesity.

Our findings however showed that the mean daily energy intake in elderly males and females residing in both urban and rural areas was lower than the Recommended Dietary Allowance for developing countries (Solomons and Bermúdez, 2008). Similar findings were reported in the survey conducted by Gillbride *et al* (1998), who observed that the average energy intake in older people (1,625 Kcal) was less than the RDA. The low energy intake may be due to an increase in immobilizing diseases and disabilities and a decline in physical activity during old age (Shahar *et al*, 2000). Lower energy intake is a cause for concern, as studies have shown a high relationship between energy intake and diet quality (McCrory *et al*, 2000). However, energy intake in the rural elderly was significantly more than the urban elderly. This may be attributed to the fact that most of the foods in the rural area were own products with easy access and low prices.

The results showed that more than 60% of intake energy was supplied by carbohydrates. Contribution of fat and proteins to total calory intake was less than 25% and 15%, respectively. The distribution showed that carbohydrates were still the main source of energy, which attributed by the habitual high intakes of starch, particularly bread and grain as staple food for Iranian elderly.

In the present research, less than 15% of the elderly obtained their energy from proteins. However, the average protein intake did not show any significant difference between the two groups from the urban and rural areas. The average protein intake in the present study was similar to earlier studies (Koochek *et al*, 2011; Nemati, 2003; Wyka and Biernat, 2010). A number of studies have pointed to proteins as a key nutrient in the elderly. Protein intake should be more than the amount required to avoid negative nitrogen balance. Evidence indicates that protein intake greater than the RDA can improve muscle mass, strength and function in the elderly. In addition other factors, including immune

status, wound healing, blood pressure and bone health may be improved by increasing the protein intake above the RDA. Optimal health status, reduced risk of chronic diseases, and improved outcomes may be achieved by increasing protein intake to approximately 1.5 g protein/kg/day or about 15%-20% of total caloric intake (Wolfe *et al*, 2008).

This study had some limitations. The participants were community living older people. There were significant differences in gender and education levels between rural and urban areas. Therefore, the results of this study may not be generalized to all older adults. In addition, the success of the 24-hour dietary method depends on the memory, cooperation, and communication ability of the subjects.

In conclusion, the results showed that the urban and rural elderly investigated in this study had a deficient intake of energy and proteins compared to the Recommended Dietary Allowance. The elderly in this study, although consuming diets high in carbohydrates, had an inadequate energy intake. The elderly from the rural areas on the other hands had significantly higher energy, carbohydrate and fat intakes compared to the urban elderly.

Ageing is a major challenge in developing countries. Hence, there is a need to provide more attention to the care and protection of the elderly by family members as well as the government. Promoting proper interventions such as consumption of foods with a high ratio of protein and emphasis on regular intake of snacks (in between meals) are essential for improving the quantity and quality of the diet of older adults. Finally, the health care providers should plan appropriate health and nutrition awareness programs for the elderly and their families.

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